

ELASTIC NONWOVEN FABRIC

FIELD OF THE INVENTION

The present invention relates to an elastic nonwoven fabric manufactured by the spunbonding method.

BACKGROUND OF THE INVENTION

Hitherto, as the surface layer material, a nonwoven fabric manufactured by the needle punching method has generally been used. Nevertheless, it is difficult to manufacture a thin nonwoven fabric by the needle punching method. Therefore, this thin nonwoven fabric has been manufactured by the spunbonding method. (Patent Literature JP2002-105832)

DISCLOSURE OF THE INVENTION

Nevertheless, the nonwoven fabric manufactured by the spunbonding method has poor elasticity along its length and width, so that in a case where said nonwoven fabric is used as a surface layer material, and is attached to the base material and molded into a prescribed shape, there is a problem in that wrinkles and cracks may occur in the deep drawn part of the resulting molded fabric.

[MEANS TO SOLVE SAID PROBLEM]

As a means to solve said problem, the present invention provides an elastic nonwoven fabric made of a nonwoven fabric manufactured by the spunbonding method, wherein a lot of holes are formed in said nonwoven fabric by the needle punching method.

It is preferable that synthetic resin be impregnated into said nonwoven fabric.

Further, it is preferable that said synthetic resin be a thermosetting resin.

Furthermore, the present invention also provides an interior material consisting of said elastic nonwoven fabric as a surface layer material, and a base material to whose surface said elastic nonwoven fabric is attached as a surface layer, then being molded into a prescribed shape.

[EFFECT OF THE INVENTION]

The elasticity of said nonwoven fabric along its length and width is improved by a lot of holes formed in said nonwoven fabric by needle punching. Accordingly, in a case where said elastic nonwoven fabric is used as a surface layer material, being attached to a base material, and molded into a prescribed shape, no wrinkles and no cracks may occur in the deep drawn part of the resulting molded article.

DETAILED DESCRIPTION OF THE INVENTION AND PREFERRED EMBODIMENTS

The nonwoven fabric used in the present invention is manufactured by the spunbonding method, wherein a thermoplastic resin is melted and extruded from the spinning die to form a lot of filaments, and the resulting filaments bond to each other in their melting state. A plural number of said nonwoven fabrics manufactured by the spunbonding method may be laminated and needle punched to form a laminated nonwoven fabric, and said laminated nonwoven fabric may be used as said nonwoven fabric of the present invention.

Said thermoplastic resin used as a material of said nonwoven fabric may include such as polyethylene, polypropylene, ethylene-propylene copolymer, ethylene-vinyl acetate copolymer, ethylene-propylene terpolymer, polyvinyl chloride, polyvinylidene chloride, polystyrene, polyvinyl acetate, fluoroplastics, thermoplastic polyacrylate, thermoplastic polyester, thermoplastic polyamide, acrylonitrile-butadiene copolymer, butadiene-styrene copolymer, acrylonitrile-butadiene-styrene copolymer or the like.

Said thermoplastic resin may be used singly or two or more kinds of said thermoplastic resin may be used together.

The thickness of said nonwoven fabric is commonly in the range of between 0.05mm and 1mm, with the fineness of fiber composing said nonwoven fabric being commonly in the range of between 0.05 dtex and 5 dtex, the unit weight of said nonwoven fabric commonly being in the range of between 10g/m²~200 g/m².

A lot of holes are needle punched into said nonwoven fabric manufactured by

the spunbonding. The shape of said holes may vary circular, elliptical, rectangular, or the like. Not every hole formed in said nonwoven fabric should necessarily be the same shape, and said holes may vary between different kinds of shapes.

The diameter of each hole should be in the range of between 0.1mm and 2mm, but desirably 0.2mm and 1.5mm. Herein, the diameter of the hole means that in the case of a circle, the diameter is the diameter of the circle, and in the case of a rectangular hole, the diameter is the length of the longest diagonal line.

The number of holes is commonly in the range of between 10/cm² and 100/cm². Synthetic resin is impregnated into said nonwoven fabric of the present invention. Said synthetic resin impregnated into said nonwoven fabric is a thermoplastic resin such as a phenol group resin, urethane resin, melamine resin, urea resin, epoxy resin, thermosetting type polyester resin, or the like. The phenol group resin used in the present invention is described below.

[Phenol group resin]

Phenol group resin is produced by the condensation reaction between a phenol group compound, and an aldehyde, and/or aldehyde donor. To give said phenol group resin water solubility, said phenol group resin may be sulfomethylated and/or sulfimethylated.

Said phenol group resin is impregnated into said nonwoven fabric as a precondensate. Usually, said precondensate is prepared as a water solution but if desired, a water soluble organic solvent may be used. Said water soluble organic solvent is such as alcohol group solvent such as methanol, ethanol, n-propanol, isopropanol, n-butanol, isobutanol, s-butanol, t-butanol, n-amyl alcohol, isoamyl alcohol, n-hexanol, methylamyl alcohol, 2-ethylbutanol, n-heptanol, n-octanol, trimethylnonyl alcohol, cyclohexanol, benzyl alcohol, furfuryl alcohol, tetrahydrofurfuryl alcohol, abiethyl alcohol, diacetone alcohol, or the like, ketone group solvent such as acetone, methylacetone, ethyl methyl ketone, methyl n-propyl ketone, methyl n-butyl ketone, isobutyl methyl ketone, diethyl ketone, di-n-propyl ketone, diisobutyl ketone, acetonylacetone, methyl oxide, cyclohexanone, methylcyclohexanone, acetophenone, camphor, or the like, glycol group solvent such as ethylene

glycol, diethylene glycol, triethylene glycol, propylene glycol, trimethylene glycol, polyethylene glycol, or the like, glycol ether group solvent such as ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, ethylene glycol isopropyl ether, diethylene glycol monomethyl ether, monomethyl triethylene glycol ether, or the like, ester of said glycol group solvent or derivative thereof such as ethylene glycol diacetate, diethylene glycol monoethyl ether acetate, or the like, ether group solvent such as 1,4-dioxane, or the like, and further diethyl cellosolve diethylcarbitol, ethyl lactate, isopropyl lactate, diglycol diacetate, dimethyl formamide, or the like.

(Phenol group compound)

The phenolic compound used to produce said phenolic resin may be monohydric phenol, or polyhydric phenol, or a mixture of monohydric phenol and polyhydric phenol, but in a case where only monohydric phenol is used, formaldehyde is apt to be emitted when or after said resin composition is cured, so that polyhydric phenol or a mixture of monohydric phenol and polyhydric phenol is preferably used.

(Monohydric phenol)

The monohydric phenols include alkyl phenols such as o-cresol, m-cresol, p-cresol, ethylphenol, isopropylphenol, xlenol, 3,5-xlenol, butylphenol, t-butylphenol, nonylphenol, or the like; monohydric phenol derivatives such as o-fluorophenol, m-fluorophenol, p-fluorophenol, o-chlorophenol, m-chlorophenol, p-chlorophenol, o-bromophenol, m-bromophenol, p-bromophenol, o-iodophenol, m-iodophenol, p-iodophenol, o-aminophenol, m-aminophenol, p-aminophenol, o-nitrophenol, m-nitrophenol, p-nitrophenol, 2,4-dinitrophenol, 2,4,6-trinitrophenol, or the like; monohydric phenols of polycyclic aromatic compounds such as naphthol, or the like. Each monohydric phenol can be used singly, or as a mixture thereof.

(Polyhydric phenol)

The polyhydric phenols mentioned above, include resorcin, alkylresorcin, pyrogallol, catechol, alkylcatechol, hydroquinone, alkylhydroquinone, phloroglucinol, bisphenol, dihydroxynaphthalene, or the like. Each

polyhydric phenol can be used singly, or as a mixture thereof. Resorcin and alkylresorcin are more suitable than other polyhydric phenols. Alkylresorcin, in particular, is the most suitable of polyhydric phenols, because it can react with aldehydes more rapidly than resorcin.

The alkylresorcins include 5-methylresorcin, 5-ethylresorcin, 5-propylresorcin, 5-n-butylresorcin, 4,5-dimethylresorcin, 2,5-dimethylresorcin, 4,5-diethylresorcin, 2,5-diethylresorcin, 4,5-dipropylresorcin, 2,5-dipropylresorcin, 4-methyl-5-ethylresorcin, 2-methyl-5-ethylresorcin, 2-methyl-5-propylresorcin, 2,4,5-trimethylresorcin, 2,4,5-triethylresorcin, or the like.

A polyhydric phenol mixture produced by the dry distillation of oil shale, which is produced in Estonia, is inexpensive, said polyhydric phenol mixture including 5-methylresorcin, along with many other kinds of alkylresorcin, being highly reactive, and making said polyhydric phenol mixture an especially desirable raw polyphenol material.

In the present invention, said phenolic compound and aldehyde and/or aldehyde donor (aldehydes) are condensed together. Said aldehyde donor refers to a compound or a mixture which emits aldehyde when said compound or said mixture decomposes. The aldehydes include formaldehyde, acetaldehyde, propionaldehyde, chloral, furfural, glyoxal, n-butylaldehyde, capronaldehyde, allylaldehyde, benzaldehyde, crotonaldehyde, acrolein, phenylacetaldehyde, o-tolualdehyde, salicylaldehyde, or the like. The aldehyde donors include paraformaldehyde, trioxane, hexamethylenetetramine, tetraoxymethylene, or the like.

As described above, said phenolic resin is desirably sulfoalkylated and/or sulfalkylated, to improve the stability of said water soluble phenolic resin.

(Sulfomethylation agent)

The sulfomethylation agents used to improve the stability of the aqueous solution of phenol resins, include such as water soluble sulfites prepared by the reaction between sulfurous acid, bisulfurous acid, or metabisulfurous acid, and alkaline metals, trimethylamine, quaternary ammonium (e.g. benzyltrimethylammonium); and aldehyde adducts prepared by the reaction between said water soluble sulfites and aldehydes.

The aldehyde adducts are prepared by the addition reaction between aldehydes and water soluble sulfites as mentioned above, wherein the aldehydes include formaldehyde, acetaldehyde, propionaldehyde, chloral, furfural, glyoxal, n-butylaldehyde, capronaldehyde, allylaldehyde, benzaldehyde, crotonaldehyde, acrolein, phenylacetaldehyde, o-tolualdehyde, salicylaldehyde, or the like. For example, hydroxymethane sulfonate, which is one of the aldehyde adducts, is prepared by the addition reaction between formaldehyde and sulfite.

(Sulfimethylation agent)

The sulfimethylation agents used to improve the stability of the aqueous solution of phenol resins, include alkaline metal sulfoxylates of aliphatic or aromatic aldehyde such as sodium formaldehyde sulfoxylate (a.k.a. Rongalit), sodium benzaldehyde sulfoxylate, or the like; hydrosulfites (a.k.a. dithionites) of alkaline metal or alkaline earth metal such as sodium hydrosulfite, magnesium hydrosulfite, or the like; hydroxyalkanesulfinates such as hydroxymethanesulfinates, or the like.

(Third component)

In the case of producing said phenol resins, if necessary, additives may be mixed in with said phenol resins as a catalyst or to adjust the pH. Such additives include acidic compounds and alkaline compounds. Said acidic compounds include inorganic acid or organic acid such as hydrochloric acid, sulfuric acid, orthophosphoric acid, boric acid, oxalic acid, formic acid, acetic acid, butyric acid, benzenesulfonic acid, phenolsulfonic acid, p-toluenesulfonic acid, naphthalene- α -sulfonic acid, naphthalene- β -sulfonic acid, or the like; esters of organic acid such as dimethyl oxalate, or the like; acid anhydrides such as maleic anhydride, phthalic anhydride, or the like; salts of ammonium such as ammonium chloride, ammonium sulfate, ammonium nitrate, ammonium oxalate, ammonium acetate, ammonium phosphate, ammonium thiocyanate, ammonium imidosulfonate, or the like; halogenated organic compounds such as monochloroacetic acid, the salt thereof, organic halogenides such as α, α' -dichlorohydrin, or the like; hydrochloride of amines such as triethanolamine hydrochloride, aniline hydrochloride, or the like;

urea adducts such as the urea adduct of salicylic acid, urea adduct of stearic acid, urea adduct of heptanoic acid, or the like; and N-trimethyltaurine, zinc chloride, ferric chloride, or the like; alkaline compounds including ammonia, amines; hydroxides of alkaline metal and alkaline earth metal such as sodium hydroxide, potassium hydroxide, barium hydroxide, calcium hydroxide, and the like; oxide of alkaline earth metal such as lime, or the like; salts of alkaline metal such as sodium carbonate, sodium sulfite, sodium acetate, sodium phosphate, or the like.

(Method of producing the phenol resins)

The phenol resins (the precondensation polymers) can be prepared using the usual method. The usual methods including method (a) comprising the condensation of a monohydric phenol and/or a polyhydric phenol and aldehydes; method (b) comprising the condensation of a precondensation polymer and a monohydric phenol and/or a polyhydric phenol, wherein said precondensation polymer comprises a monohydric phenol and aldehydes; method (c) comprising the condensation of a precondensation polymer and a monohydric phenol and/or a polyhydric phenol, wherein said precondensation polymer comprises a monohydric phenol, a polyhydric phenol and aldehydes; method (d) comprising the condensation of a precondensation polymer consisting of a monohydric phenol and aldehydes, with a precondensation polymer consisting of a polyhydric phenol and aldehydes; and method (e) comprising the condensation of a precondensation polymer consisting of a monohydric phenol and aldehydes and/or precondensation polymers consisting of a polyhydric phenol and aldehydes, with a precondensation polymer consisting of a monohydric phenol and polyhydric phenol and aldehydes.

In the present invention, the desirable phenolic resin is phenol-alkylresorcin cocondensation polymer. Said phenol-alkylresorcin cocondensation polymer provides a water solution of said cocondensation polymer (pre-cocondensation polymer) having good stability, and being advantageous in that it can be stored for a longer time at room temperature, compared with a condensate consisting of a phenol only (precondensation polymer). Further, in a case where said water solution is impregnated into said nonwoven fabric, after

which said nonwoven fabric is precured to put said phenol resin at its B-stage, said phenol group resin at its B-stage in said nonwoven fabric may be stable, so that said nonwoven fabric keeps a good moldability for a longtime. Further, since alkylresorcin is highly reactive to aldehyde, and catches free aldehyde to react with it, the content of free aldehyde in the resin can be reduced.

Said phenol-alkylresorcin cocondensation polymer is also advantageous in that the content of free aldehyde in said polymer is reduced by the reaction with alkylresorcin.

The desirable method for producing said phenol-alkylresorcin cocondensation polymer is first to create a reaction between phenol and aldehyde to produce a phenolic precondensation polymer, and then to add alkylresorcin, and if desired, aldehyde, to said phenolic precondensation polymer to create a reaction.

In the case of method (a), for the condensation of monohydric phenol and/or polyhydric phenol and aldehydes, the aldehydes (0.2 mole to 3 moles) are added to said monohydric phenol (1mole), then said aldehydes (0.1 mole to 0.8 mole) are added to the polyhydric phenol (1mole) as usual. If necessary, additives may be added to the phenol resins (the precondensation polymers). In said method(s), there is a condensation reaction from heating at 55°C to 100°C for 8 to 20 hours. The addition of aldehydes may be made at one time at the beginning of the reaction, or several separate times throughout the reaction, or said aldehydes may be dropped in continuously throughout the reaction.

In the case of sulfomethylation and/or sulfimethylation, the sulfomethylation agents and/or sulfimethylation agents may be added to the precondensation polymers at an arbitrary time.

The addition of the sulfomethylation agents and/or sulfimethylation agents may be made any time, such as before, during, or after condensation.

The total amount of said sulfomethylation agent and/or sulfimethylation agent added is usually in the range of between 0.001 and 1.5 moles per 1mole of phenol. In a case where said amount added is less than 0.001 mole, the hydrophile of the resulting sulfomethylated and/or sulfimethylated phenolic resin is not adequate, and in a case where said amount added is more than 1.5 moles, the water resistance of the resulting sulfomethylated and/or

sulfomethylated phenolic resin degrades. To provide excellent curing properties in the resulting precondensate and excellent physical properties in the cured resin, said amount to be added is preferably in the range of between 0.01 and 0.8 mole per 1 mole of phenol.

The sulfomethylation agents and/or sulfimethylation agents for sulfomethylation and/or sulfimethylation react with the methylol groups and/or aromatic groups, so that the sulfomethyl group and/or sulfimethyl group are introduced to the precondensation polymers.

The solution of precondensation polymers of sulfomethylated and/or sulfimethylated phenol resins is stable even in a wide range of acidic condition (e.g. pH=1.0) or alkaline condition, so that the solution can be cured in any conditions such as acid, neutral or alkaline. In the case of curing the precondensate under acidic condition, there is a decrease in the remaining methylol groups, so that no formaldehydes from the decomposed cured phenol resins appear.

Further, if necessary, the phenol resins and/or precondensation polymers thereof may be copolycondensed with amino resin monomers such as urea, thiourea, melamine, thiomelamine, dicyandiamine, guanidine, guanamine, acetoguanamine, benzoguanamine, 2,6-diamino-1,3-diamine, or the like.

Further, curing agents such as an aldehyde and/or an aldehyde donor or an alkylol triazine derivative, or the like, may be added to said phenolic precondensation polymer (including precondensation polymer).

As said aldehyde and/or aldehyde donor, the same aldehyde and/or aldehyde donor as used in the production of said phenolic precondensation polymer is (are) used, and an alkylol triazine derivatives are produced by the reaction between urea group compound, amine group compound, and aldehyde and/or aldehyde donor. Said urea group compound used in the production of said alkylol triazined derivatives may be such as urea, thiourea, and alkylurea such as methylurea, an alkylthiourea such as methylthiourea; phenylurea, naphthylurea, halogenated phenylurea, nitrated alkylurea, or the like, or a mixture of two or more kinds of said urea group compounds. A particularly, desirable urea group compound may be urea or thiourea. As the amine group compounds, aliphatic amine such as methyl amine, ethylamine, propylamine,

isopropylamine, butylamine, amylamine or the like, benzylamine, furfurylamine, ethanolamine, ethylenediamine, hexamethylenediamine, hexamethylenetetramine, or the like, as well as ammonia are illustrated, and said amine group compound is used singly or two or more amine group compounds may be used together.

The aldehyde and/or aldehyde donor used for the production of said alkylol triazine derivative is (are) the same as the aldehyde and/or aldehyde donor used for the production of said phenolic precondensation polymer.

To synthesize said alkylol triazine derivatives, commonly 0.1 to 1.2 moles of said amine group compound(s) and/or ammonia, and 1.5 to 4.0 moles of aldehyde and/or aldehyde donor are combined to react with 1 mole of said urea group compound.

In said reaction, the order in which said compounds are added is arbitrary, but preferably, first the required amount of aldehyde and/or aldehyde donor is (are) put in a reactor, then the required amount of amine group compound(s) and/or ammonia is (are) gradually added to said aldehyde and/or aldehyde donor, the temperature being kept at below 60°C, after which the required amount of said urea group compound(s) is (are) added to the resulting mixture, then said mixture is agitated and heated at 80 to 90°C for 2 to 3 hours so as to react together. Usually, 37% by mass of formalin is used as said aldehyde and/or aldehyde donor, but some of said formalin may be replaced with paraformaldehyde to increase the concentration of the reaction product.

Further, in a case where hexamethylenetetramine is used, the solid content of the reaction product obtained is much higher. The reaction between said urea group compound, said amine group compound and/or ammonia and said aldehyde and/or aldehyde donor is commonly performed in a water solution, but said water may be partially or wholly replaced by one or more kinds of alcohol(s) such as methanol, ethanol, isopropanol, n-butanol, ethylene glycol, diethylene glycol, or the like, and one or more kinds of other water soluble solvent(s) such as a ketone group solvent like acetone, ethyl methyl ketone, or the like can also be used as solvents.

The amount of said curing agent to be added is, in the case of an aldehyde and/or aldehyde donor, in the range of between 10 and 100 parts by mass to

100 parts by mass of said phenolic precondensation polymer (precopolycondensation polymer), and in the case of alkylol triazine, 10 to 500 parts by mass to 100 parts by mass of said phenolic precondensation polymer (precopolycondensation polymer).

Said synthetic resin is commonly prepared as a solution and one or more kind(s) of third component(s) may be added to said solution. Said third component is, for example, water-soluble polymer and natural gums such as poly(vinyl alcohol), sodium alginate, starch, starch derivatives, glue, gelatin, blood powder, methylcellulose, carboxymethylcellulose, polyacrylate, polyacrylamide or the like; fillers and surfactants such as calcium carbonate, magnesium carbonate, barium sulfate, calcium sulfite, calcium phosphate, calcium hydroxide, magnesium hydroxide, aluminum hydroxide, magnesium oxide, titanium oxide, iron oxide, zinc oxide, alumina, silica, diatom earth, dolomite, gypsum, talc, clay, asbestos, mica, calcium silicate, bentonite, white carbon, carbon black, iron powder, aluminum powder, glass powder, stone powder, synthetic resin powder, blast furnace slag, fly ash, cement, zirconia powder, wood flour, wheat flour, walnut flour, coconut flour, ground rice, or the like; higher fatty acid such as stearic acid, palmitic acid, or the like; higher alcohol such as palmityl alcohol, stearyl alcohol, or the like; carboxylic ester such as butyl stearate, glycerol, monostearate or the like; carboxylic amide; natural wax and synthetic wax such as carnauba wax, or the like; pigment, dye, burning retardant, flame retardant, insecticide, antiseptic agent, age resister, ultraviolet absorber, fluorescent dye, surfactant, foaming agent, oil repellent agent, or the like.

In a case where said thermosetting resin is impregnated into said nonwoven fabric, said nonwoven fabric may be dried after the impregnation of said resin, to put said resin in said nonwoven fabric at its B-stage.

A powder or film of hot-melt adhesive may be applied or laminated onto said nonwoven fabric. Said hot-melt adhesive is, for example, a polyolefin resin such as polyethylene, polypropylene, ethylene-vinyl acetate copolymer, or a modified polyolefin resin, polyvinyl chloride, polyurethane, polyester, ester copolymer, polyamide, polyamide copolymer, cellulose derivative, polyvinylether, or the like.

Said elastic nonwoven fabric (1) of the present invention has a lot of holes (2) from needle punching, as shown in Fig.1, so that the elasticities along the length and width of said nonwoven fabric are improved by said holes, and accordingly, said nonwoven fabric is easily attached to other material without forming wrinkles, even in a case where said nonwoven fabric is attached to parts having an uneven surface,

Said parts to which said nonwoven fabric is attached have a desirable appearance. Said elastic nonwoven fabric (1) is used for a surface layer(2) of an interior(3).

Said nonwoven fabric of the present invention is manufactured by the spunbonding method, but in the present invention, a nonwoven fabric manufactured by the melt-blow method or the calendar treatment can be used.

[Interior]

An interior can be manufactured by attaching said elastic nonwoven fabric of the present invention to a base material as a surface layer, then molding said base material onto which said elastic nonwoven fabric is attached, into a prescribed shape.

As said base material, knitted or woven fabric, nonwoven fabric, felt and laminated fabrics thereof, foamed plastics having connected cells, sintered plastic beads, or the like are used. Said fabric is made of a synthetic fiber such as polyester fiber, polyethylene fiber, polypropylene fiber, polyamide fiber, acrylic fiber, polyurethane fiber, polyvinyl chloride fiber, polyvinylidene chloride fiber, acetate fiber, or the like, botanical fiber such as pulp, cotton, coconut fiber, hemp, bamboo fiber, kenaf fiber, or the like, inorganic fiber such as glass fiber, carbon fiber, ceramics fiber, asbestos fiber, or the like, or recycled fiber from the scrap of the products made of said fiber, or a fiber mixture containing two or more kinds of said fibers.

Said foamed plastic is made of plastic such as polyurethane (flexible polyurethane, rigid polyurethane), polyethylene, polypropylene, polyamide, polyester, polyvinyl chloride, or the like.

A synthetic resin may be impregnated into said base material. Said synthetic resin includes thermoplastic resins such as polyethylene,

polypropylene, ethylene-propylene copolymer, ethylene-vinyl acetate copolymer, polyvinyl chloride, polyvinylidene chloride, polystyrene, polyvinyl acetate, fluoride resin, thermoplastic acrylic resin, thermoplastic polyester resin, thermoplastic polyamide resin, acrylonitrile-butadiene copolymer, butadiene-styrene copolymer, acrylonitrile-butadiene-styrene copolymer, or the like, and thermosetting resin such as urethane resin, melamine resin, urea resin, thermosetting acrylic resin, phenol resin, resorcinol resin, alkylresorcinol resin, epoxy resin, thermosetting polyester, or the like.

In a case where said thermosetting resin is impregnated, said base material into which said thermosetting resin is impregnated is preferably dried, to put said thermosetting resin at its B-stage.

To attach said surface layer made of said elastic nonwoven fabric to said base material, said surface layer is put on said base material, after which said base material is hot-pressed or heated, and then cold-pressed.

In the case of molding said base material onto which said surface layer is attached, said base material is preferably molded at the same time that said surface layer is attached to said base material.

In a case where said base material is molded concurrently to when said surface layer is attached, said surface layer is attached to said base layer with enough elasticity to give the resulting molded interior a good appearance.

The resulting interior may be used for automobile parts such as the door trim, dashboard, head lining, hood insulator, engine cover, or the like, or as an automobile heat insulating material and sound proof material, building material, wall material, building heat insulating material, building sound proof material, or the like.

The present invention is explained in the EXAMPLES described below, and further, the present invention is not limited to the specific EXAMPLES described below.

[EXAMPLE 1]

A nonwoven fabric made of a polyester fiber (fineness: 3.5 dtex, unit weight: 40g/m²) was manufactured by the spunbonding method.

To form a lot of holes in said nonwoven fabric, said nonwoven fabric was

pressed by a needle roller on whose surface a lot of needles were randomly arranged, each needle having a maximum diameter of 1mm. The resulting nonwoven fabric had a lot of holes, the diameter of each of said holes being in the range of between 0.1mm and 0.3mm, with 15 holes being formed per 1 cm² of said nonwoven fabric.

Further, a phenol-formaldehyde precondensate (solid content 30% by mass) was impregnated into said hole punched nonwoven fabric in an amount of 30% by mass as solid content. After impregnating with said precondensate, said nonwoven fabric was dried at 150°C for 3 minutes for precuring, to obtain an elastic nonwoven fabric.

[EXAMPLE 2]

An elastic nonwoven fabric was manufactured in the same manner as in EXAMPLE 1, with the exception that a lot of holes were formed, each hole having a diameter in the range of between 0.1mm and 0.3mm, with 50 such holes being formed per 1 cm² of said nonwoven fabric.

[EXAMPLE 3]

An elastic nonwoven fabric was manufactured in the same manner as in EXAMPLE 1, with the exception that a lot of holes were formed, each hole having a diameter in the range of between 0.1mm and 0.3mm, with 100 holes being formed per 1 cm² of said nonwoven fabric.

[COMPARISON 1]

An elastic nonwoven fabric was manufactured in the same manner as in EXAMPLE 1, with the exception that a lot of holes were formed, each hole having a diameter in the range of between 0.1mm and 0.3mm, with 8 holes being formed per 1 cm² of said nonwoven fabric.

[COMPARISON 2]

An elastic nonwoven fabric was manufactured in the same manner as in EXAMPLE 1, with the exception that a lot of holes were formed, each hole having a diameter in the range of between 0.1mm and 0.3mm, with 110 holes being formed per 1 cm² of said nonwoven fabric.

[TEST]

Said elastic nonwoven fabrics (1) manufactured in EXAMPLES 1 to 3, and COMPARISONS 1 and 2, were each used as surface layers (1A).

A phenol-formaldehyde precondensate was coated onto a glass wool sheet (7) as a base material, and said glass wool mat (7) (unit weight: 800g/m², thickness: 50mm) on which said phenol-formaldehyde precondensate was coated was then precured, and each surface layer (1A) was put on said precured base material (7), and each precured base material (7) upon which each surface layer (1A) was put was then respectively molded with a mold (3) consisting of an upper mold (4) and a lower mold (5), as shown in Fig. 2, at 200 °C for 60 seconds, to manufacture a molded article (6) (thickness 5mm), as shown in Fig. 3.

The appearance of each molded article (6) was observed optically. The results are shown in Table 1.

Table 1

Molded Sheet(6)	Number of Holes(per 1 cm ²)	Appearance of Molded Sheet(6)(Surface Layer in particular (1A))
EXAMPLE 1	15	No wrinkles, no peeling, good appearance
EXAMPLE 2	50	No wrinkles, no peeling, good appearance
EXAMPLE 3	100	No wrinkles, no peeling, good appearance
COMPARISON 1	8	Wrinkles occur on the corner part(9) of the molded sheet
COMAPRISON 2	110	Peeling of nonwoven fabric on the incline part(8)

[EXAMPLE 4]

A nonwoven fabric made of a polypropylene fiber(fineness: 0.1 dtex unit weight : 30g/m²) was manufactured by the spunbonding method.

To form a lot of holes in said nonwoven fabric, said nonwoven fabric was pressed by a needle roller on whose surface a lot of needles were randomly arranged, each needle having a maximum diameter of 1mm. The resulting nonwoven fabric had a lot of holes, the diameters of said holes being in the range of between 0.8mm and 1.2mm, with 25 holes being formed per 1 cm² of said nonwoven fabric.

Further, a phenol-formaldehyde precondensate (solid content: 40% by mass) was impregnated into said holepunched nonwoven fabric in an amount of 25% by mass as a solid. After impregnating with said precondensate, said nonwoven fabric was dried at 150°C for 3 minutes for precuring, to obtain an elastic nonwoven fabric.

Said nonwoven fabric, used as a surface layer, was put on a base material, said base material being manufactured by coating a phenol formaldehyde precondensate onto a glass wool mat (unit weight 600g/m², thickness: 40mm) and precuring said glass wool mat upon which said phenol formaldehyde precondensate was coated. Said base material upon which said surface layer was put was then molded at 210°C for 45 seconds into a prescribed shape by the hot-press method, to obtain a molded article. Said molded article has no wrinkles and no other defects in appearance.

[EXAMPLE 5]

A nonwoven fabric made of a polyester fiber(fineness: 2.0 dtex, unit weight : 60g/m²) was manufactured by the spunbonding method. To form a lot of holes in said nonwoven fabric, said nonwoven fabric was pressed by a needle roller on whose surface a lot of needles were randomly arranged, each needle having a maximum diameter of 1mm. The resulting nonwoven fabric had a lot of holes, the diameters of said holes being in the range of between 0.5mm and 0.8mm, with 18 holes being formed per 1 cm² of said nonwoven fabric.

Further, a phenol-alkylresorcine-formaldehyde precondensate used in EXAMPLES 4 (solid content :40% by mass) was impregnated into said holepunched nonwoven fabric in an amount of 30% by mass as a solid, after which a polyamide group hot-melt adhesive powder (200 mesh pass, melting point 130 °C) was sprayed on the reverse side of said nonwoven fabric. Following this, said nonwoven fabric was heated at 150°C for 2 minutes, to obtain an elastic nonwoven fabric on whose reverse side said hot-melt adhesive powder was applied.

[COMPARISON 3]

An elastic nonwoven fabric was manufactured in the same manner as in EXAMPLE 5, with the exception that a lot of holes, each having a diameter in

the range of between 2.1mm and 2.4mm, were formed in said nonwoven fabric.

[COMPARISON 4]

A nonwoven fabric (unit weight: 60g/m²) made of a fiber mixture containing 90% by mass of said polyester fiber used in EXAMPLE 5, and 10% by mass of a low melting point polyester fiber (fineness: 2.0 dtex, softening point: 110°C) was manufactured by needle punching (unit weight: 60g/m²).

Said phenol-alkylresorcine-formaldehyde precondensate used in EXAMPLE 5 (40% by mass as a solid) was impregnated into said nonwoven fabric in an amount of 30% by mass as a solid, after which said polyamide group hot-melt adhesive powder used in EXAMPLE 5 was sprayed onto said nonwoven fabric, into which said precondensate was impregnated.

Following this, said nonwoven fabric was dried at 150°C for 2 minutes, to obtain an elastic nonwoven fabric upon which said hot-melt adhesive powder was applied.

Each elastic nonwoven fabric manufactured in EXAMPLE 5 and COMPARISONS 3 and 4 were used for a surface layer. Each surface layer was put on a glass wool mat onto which a phenol formaldehyde precondensate was coated and precured (unit weight: 1000g/m², thickness 70mm), and said glass wool mat, upon which said nonwoven fabric was put, was molded into a prescribed shape by the hot-press method at 200°C for 50 seconds, to obtain a molded article. The appearance of each molded article was observed optically. The results are shown in Table 2.

Table 2

Sample	Appearance of molded article (surface layer in particular)
EXAMPLE 5	No wrinkles, no peeling, no snags in the surface layer, very good appearance
COMPARISON3	Snags in the uneven part of the molded base material
COMPARISON4	Good moldability, but noticeable fluff in the surface layer of the thick area of the molded base part

Since nonwoven fabric manufactured by the traditional spunbonding method

has poor elasticity along its length and width, it is recognized that wrinkles easily occur in the surface layer of the uneven area of the base material when said nonwoven fabric is attached to said base material as a surface layer, and further, that said surface layer is easy to remove from the uneven part of said base material (defective bonding).

Further, nonwoven fabric manufactured by the needle punching method has a good elasticity along its length and width, so that said nonwoven fabric (surface layer) attaches well to the base material, but, since fluffs occur on the surface of said nonwoven fabric, the appearance of the resulting molded article is imperfect.

The molded article using said elastic nonwoven fabric of the present invention as a surface layer has an excellent appearance and good moldability.

POSSIBILITY OF INDUSTRIAL USE

The elastic nonwoven fabric of the present invention can be used for the surface layer of an automobile interior, for such as the door trim, head lining, hood insulator, engine cover, or the like, as a surface layer for an automobile heat insulating material, or sound proof material, a surface layer for building material, wall material, building heat insulating material, building sound proof material, or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the elastic nonwoven fabric.

Fig. 2 is a sectional view illustrating the mold.

Fig. 3 is a sectional side view of the molded article.

1. nonwoven fabric
2. hole